

Remarks:

Reconsideration of the application is respectfully requested.

Claims 1 - 4 are presently pending in the application. Claims 1 and 4 have been amended to correct a typographical error.

On page 2 of the above-identified Office Action, the specification was objected to for not explicitly naming the semiconductor substrate, shown in the figures and recited in the claims. The specification has been amended to particularly set forth that the n-basis 1 is the semiconductor substrate of the claims, as suggested by the Examiner on page 3 of the Office Action.

In item 2 of the Office Action, claims 1 - 4 were objected to because the word "semiconductor" was misspelled in those claims. The Examiner's suggested correction has been made.

In item 4 of the Office Action, claims 1 and 3 were rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U. S. Patent No. 5,668,385 to Bauer et al ("BAUER") in view of German Patent Publication No. DE 3917769 A1 to Gerstenmaier et al ("GERSTENMAIER"). In item 5 of the Office Action, claim 4 was rejected under 35 U.S.C. § 103(a) as allegedly being obvious over BAUER in view of GERSTENMAIER. In item 6 of the Office Action, claim 2 was rejected under 35 U.S.C. § 103(a)

as allegedly being obvious over BAUER in view of GERSTENMAIER and further in view of U. S. Patent No. 5,684,323 to Tohyama ("TOHYAMA").

Applicants respectfully traverse the above rejections.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

Claim 1 recites, a power semiconductor element, comprising:

"a semiconductor substrate doped with doping atoms of a first conductivity type;

an emitter region doped with doping atoms of a second conductivity type;

said emitter region and said semiconductor substrate having mutually opposite conductivities;

a stop zone in front of the emitter region for preventing passage of an electric field to said emitter region at a reverse voltage;

said emitter region and said stop zone having mutually opposite conductivities; and

said stop zone having atoms of a doping substance of said first conductivity type determining a conductivity of said stop zone, said atoms of said doping substance having at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor wherein a number of effective doping atoms generated in the stop zone changes in dependence on whether the power semiconductor element is in a blocking operation or in a conducting operation." [emphasis added by Applicants]

Applicants' claim 4 recites similar limitations, to those recited above.

As stated on pages 5 and 8 of the Office Action, the **BAUER** reference does not teach:

" . . . that said atoms of said doping substance have at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor wherein a number of effective doping atoms generated in the stop zone changes in dependence on whether the power semiconductor element is in a blocking operation or in a conducting operation."

Rather, the Office Action cites the **GERSTENMAIER** reference as allegedly teaching or suggesting the above cited quoted limitation of Applicants independent claims, not taught by **BAUER**. More particularly, regarding **GERSTENMAIER**, the Office Action states:

*"However, it would have been obvious to include said further limitation in view of Gerstenmaier et al, who, in a published patent application on a thyristor (cf. title; hence closely related to the GTO (Gate-Turn-Off) thyristor relevant art by F. Bauer et al; see F. Bauer, abstract), teach that in n-type recesses 11 (cf. Figure 1) the dopant should be selected so as to have an ionization energy level within the band gap of the semiconductor and at least 300 meV away, a fortiori at least 200 meV away, from both a conduction band and a valence band of the semiconductor (cf. col. 2, l. 49- col. 3, l. 17), for the specifically stated purpose to reduce the temperature dependence of the threshold current (cf. abstract and col. 2, l. 30 - col. 3, l. 17) through an increase in the slope of the conductivity versus temperature. The strong dependence on temperature of the occupancy level of the conduction band (cf. col. 3, l. 2-6) inherently implies the number*

of effective doping atoms generated in the stop zone, i.e., the number of atoms having contributed a charge carrier to the conduction band, to change in dependence on whether the power semiconductor element is in a blocking operation (no ohmic heating) or in a conducting operation (ohmic heating), because in the conducting state the temperature is higher relative to the blocking state in view of the ohmic heating associated with any current flow in a resistive medium." [emphasis in original]

Applicant respectfully disagrees with the analysis made in the Office Action. The n-type recesses 11 of GERSTENMAIER, cited in the Office Action, are not equivalent to Applicants' particularly claimed "stop zone". Applicants believe that the GERSTENMAIER reference neither teaches, nor suggests a **stop zone**, as required by all of Applicants claims. Rather, GERSTENMAIER discloses doping the extensions 11, 11a to generate thermally conductive semiconductor material such that the electric resistance of the extensions 11, 11a will be high at low temperatures and vice versa. As a result, the ignition current in GERSTENMAIER will be less dependent on temperature.

In contrast to GERSTENMAIER, in Applicants' invention, the **stop zone** is intended to prevent the passage of the electric field to the p-emitter at reverse voltage by doping with dopants which have energy levels in the band gap of the semiconductor element. Therefore, the **stop zone** will be active only in the off state of the circuit element.

Consequently, the doped extensions 11, 11a of GERSTENMAIER and the **stop zone** of Applicants' claimed invention **act in a completely different physical manner**. As such, GERSTENMAIER cannot possibly teach or suggest the doping of the **stop zone**, as recited in Applicants' claimed invention. This is because, in order to realize Applicants' presently claimed invention, an expert would select a doping material which has energy levels within the band gap of the semiconductor material, such that the **stop zone** will be active only in the off states, while according to the invention of GERSTENMAIER, a doping material will be selected such that the extensions 11, 11a will be thermally conductive. Therefore, absent impermissible hindsight reconstruction, it would not be obvious to use the dopants disclosed in GERSTENMAIER, in combination with the thyristor of BAUER, to obtain Applicants' claimed invention.

It is accordingly believed that none of the references, whether taken alone or in any combination, teach or suggest the features of claims 1 and 4. Claims 1 and 4 are, therefore, believed to be patentable over the art. The dependent claims are believed to be patentable as well because they all are ultimately dependent on claim 1. As it is believed that the claims were patentable over the cited art in their original form, the claims have not been amended to overcome the references.

In view of the foregoing, reconsideration and allowance of claims 1 - 4 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate receiving a telephone call so that, if possible, patentable language can be worked out.

Additionally, please consider the present as a petition for a three (3) month extension of time, and please provide a three (3) month extension of time, to and including, March 13, 2005 to respond to the present Office Action.

The extension fee for response within a period of three (3) months pursuant to Section 1.136(a) in the amount of \$1,020.00 in accordance with Section 1.17 is enclosed herewith.

Please provide any additional extensions of time that may be necessary and charge any other fees that might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Applic. No. 09/761,240  
Response Dated March 14, 2005  
Responsive to Office Action of September 13, 2004

Respectfully submitted,

  

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**For Applicants**

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KPS:cgm

March 14, 2005

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